

Preface

Radiometric Tracking Techniques for Deep Space Navigation is an introduction to newcomers in this field, a reference to professionals in related fields, and an exposition of the current state of the art. It focuses on a broad array of technologies and concepts developed over the last four decades to support radio navigation of interplanetary spacecraft. The technical terms in the text assume that the reader is familiar with basic engineering and mathematical concepts contained in books such as *The Electronics of Radio* (D. B. Rutledge, Cambridge University Press, 1999) and *Applied Optimal Estimation* (A. Gelb, editor, MIT Press, 1974).

In addition to an overview of Earth-based radio navigation techniques, the scope of this monograph includes a simplified conceptual presentation of each radiometric measurement type, its information content, and expected measurement accuracy. More rigorous treatments may be found in the numerous references cited. Many of these references pertain to work done at the Jet Propulsion Laboratory (JPL) as part of the development of the very system that is the topic of this monograph.

Beyond describing the types of radio measurements that *could* be made, we also suggest what measurements *should* be made under various mission conditions. The methods we describe for both acquiring and calibrating radiometric measurements provide a robust system to support guidance and navigation for future robotic space exploration.

We have drawn the content of this monograph from the work of many JPL colleagues, past and present, in the Tracking Systems and Application Section and the Navigation and Flight Mechanics Section, who have participated in the effort to develop and use state-of-the-art radiometric navigation techniques. We are especially indebted to William G. Melbourne for

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